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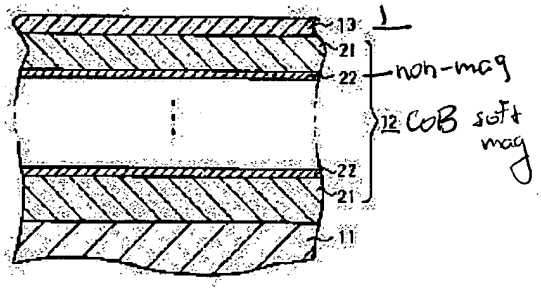
(54) VERTICAL MAGNETIC RECORDING MEDIUM

(57)Abstract:
PURPOSE: To realize a vertical magnetic recording medium being superior in productivity and having excellent recording-reproducing characteristics.
CONSTITUTION: The vertical magnetic recording medium is constructed from a nonmagnetic base 11 and a soft magnetic backing layer 12 and a vertical magnetization recording layer 13 provided thereon. In this vertical magnetic recording medium, a CoB film 21 is used for the soft magnetic backing layer 12 and the film is divided into at least two layers or more by a nonmagnetic film 22.



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clm 1, 3
¶ 15-20
Fig 1, 2, 4

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] It is the vertical-magnetic-recording medium characterized by for the above-mentioned soft-magnetism backing layer (12) dividing this film at least by the nonmagnetic membrane (22) using a CoB film (21) in the vertical-magnetic-recording medium which consists of a nonmagnetic substrate (11), and the soft-magnetism backing layer (12) and perpendicular magnetic recording layer (13) prepared on it more than two-layer, and changing.
[Claim 2] The vertical-magnetic-recording medium of the claim 1 which sets thickness of the above-mentioned nonmagnetic membrane (22) to 10nm or more, and is characterized by setting up each thickness so that it may become 1/2 or less at least about a thickness ratio with a CoB film (21).
[Claim 3] The vertical-magnetic-recording medium of the claim 1 characterized by having formed the hard magnetism film or the half-hard magnetism film (31) on the above-mentioned nonmagnetic substrate (11), and forming a soft-magnetism backing layer (12) after giving the residual magnetization of 1 shaft orientations to this film.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the vertical-magnetic-recording medium which uses for the magnetic disk unit of vertical magnetic recording, and has good record reproducing characteristics, and was excellent in productivity.
[0002] Informational record is performed in the conventional magnetic disk unit by the horizontal recording method which magnetizes a record medium horizontally. By this method, the minute magnet horizontally magnetized to the record layer opposes with the next magnet, there is, and it will weaken magnetization mutually. If information is recorded with high density, this influence will appear notably and a limitation will produce it to informational high-density record.
[0003] Vertical magnetic recording is proposed as what overthrows this limitation, and there is a bilayer film medium which carried out the laminating of a CoCr film and the NiFe film as most general thing of a record medium that realizes it. A CoCr film is a record layer, and leaves and records magnetization perpendicularly to a film. For a NiFe film to be a backing layer, and to play the role returned to a head after the record magnetic field from the magnetic head magnetizes a CoCr record layer, to consider it to be a part of magnetic head, and to have the outstanding soft-magnetism property is needed.
[0004]
[Description of the Prior Art] The record medium of the conventional perpendicular bilayer film forms the backing layer 12 and the perpendicular magnetic recording layer 13 of high permeability on the nonmagnetic disk substrate 11, as shown in drawing 5 , and the NiFe film which used the electrolysis galvanizing method and was formed at the thickness of 4 micrometers for example, on the nonmagnetic substrate 11 which consists of aluminum which performed NiP surface treatment is used for the backing layer 12. As thickness of this backing layer 12, if dispersion in the record reproducing characteristics in a round of a disk (modulation) etc. is taken into consideration, 3-4 micrometers or more are required.
[0005] Moreover, what formed CoCr in thickness of 0.15 micrometers by the spatter is used for the perpendicular magnetic recording layer 13. Furthermore, a lubricous protective coat is prepared on the perpendicular magnetic recording layer 13 if needed.
[0006] 2.5 more inches of disk sizes which the magnetic disk unit using such a record medium progresses quickly, and recent years and a miniaturization use are small from 5.25 inches to 3.5 inches.
[0007] Thus, it becomes a big burden, in forming the NiFe film of the backing layer which the man day of setting to membrane formation equipment starts, especially forms membranes with electrolysis plating, if disk size becomes small. moreover, the saturation magnetic flux density of a NiFe film -- at most -- 10000Gauss(es) it is -- as the backing layer which bears a role of a part of head as described above -- a head magnetic pole -- the same -- 13000 - 15000Gauss ** -- carrying out is desirable What is necessary is just to use the CoB film of high saturation magnetic flux density which can form membranes with electroless plating as a high backing layer of such saturation magnetic flux density.
[0008]
[Problem(s) to be Solved by the Invention] Although the property is excellent, since the above-mentioned CoB film is formation by the electroless-plating method, if thickness becomes thick, the rate of a deposit of CoB will fall, and it has the problem that it becomes difficult for it to be stabilized and to form a film with a thickness of 1 micrometers or more. Moreover, in order to abolish dispersion in the record reproducing characteristics in a round of a disk (modulation), it is necessary to arrange the magnetic anisotropy within the disk side of a backing layer in the same direction.
[0009] this invention tends to realize the vertical-magnetic-recording medium which is excellent in productivity and has good record reproducing characteristics.
[0010]
[Means for Solving the Problem] In the vertical-magnetic-recording medium of this invention, the above-mentioned soft-magnetism backing layer 12 is characterized by dividing this film at least by the nonmagnetic membrane 22 more than two-layer, and changing using the CoB film 21, in the vertical-magnetic-recording medium which attains to the nonmagnetic substrate 11 and the soft-magnetism backing layer prepared on it, and consists of a perpendicular magnetic recording layer 13. moreover, it -- in addition, thickness of the above-mentioned nonmagnetic membrane 22 is set to 10nm or more, and it is characterized by setting up each thickness so that it may become 1/2 or less at least about a thickness ratio with the CoB film 21
[0011] Moreover, after forming a hard magnetism film or a half-hard magnetism film (31) on the above-mentioned nonmagnetic substrate 11 and giving the residual magnetization of 1 shaft orientations, for example, radial [of the nonmagnetic substrate 11], or a circumferencial direction to this film, it is characterized by forming the soft-magnetism backing layer 12.

[0012] By taking this composition, the vertical-magnetic-recording medium which is excellent in productivity and has good record reproducing characteristics is obtained.
[0013]
[Function] In this invention, the CoB film of thickness which can stabilize and deposit by dividing this CoB film 12 at least by the nonmagnetic membrane 22 more than two-layer can be formed on a nonmagnetic membrane, using the CoB film 21 as a soft-magnetism backing layer 12, and it becomes possible to obtain the backing layer of the thickness of mum order by forming membranes repeatedly to the thickness of a request of it.
[0014] Moreover, by forming the film 31 of hard magnetism or half-hard magnetism between the nonmagnetic substrate 11 and the soft-magnetism backing layer 12, since the magnetic anisotropy of the CoB film 21 which is a soft-magnetism backing layer by giving residual magnetization to radial or the circumferencial direction is arranged with radial or a circumferencial direction and ********** in a round of a disk becomes uniform about this film 31, it becomes possible to acquire a good modulation property.
[0015]
[Example] Drawing 1 is the cross section showing the 1st example of this invention. this example on the nonmagnetic substrate 11 which consists of aluminum which performed NiP surface treatment Form 0.5 micrometers of CoB films 21, and 0.1 micrometers of nonmagnetic membranes 22 which consist of NiP are formed on it. Succeedingly, the CoB film was formed to six layers, the NiP film was formed alternately [five layer], and it formed in the thickness of 3.5 micrometers as sum total thickness of CoB as all thickness as 0.5 micrometers (0 1x5 micrometers) and a soft-magnetism backing layer 12 as sum total thickness of 3.0 micrometers (0.5x6 micrometers) and NiP. Furthermore, 0.1 micrometers of perpendicular magnetic recording layers 13 of CoCrTa were formed by the spatter on this.
[0016] Here, the membrane formation by electroless plating of a CoB film heats the plating solution which makes a cobalt sulfate and dimethylamine borane a principal component at 60 degrees C, and carries out being predetermined-time immersed. Moreover, the membrane formation by electroless plating of a NiP film heats the plating solution which makes a nickel chloride and sodium hypophosphite a principal component at 80-90 degrees C, and carries out being predetermined-time immersed. Moreover, the membrane formation conditions by the spatter of a CoCrTa film are 250 degrees C in power density 5.5 w/cm2, gas ** 5mTorr, and substrate temperature.
[0017] It becomes possible to obtain a thing with a thickness of 3 micrometers or more as a backing layer by the above multilayer formation, and the thing almost of the same grade is obtained as compared with the NiFe film of the former reproducing characteristics / record /, such as a reproduction output and D50,]. Moreover, since a CoB film and NiP film can also form a membrane formation process with electroless plating, exchange of a substrate anchoring fixture is unnecessary, and since the film of multilayer structure can be formed by soaking in the bath of a CoB film, and the bath of a NiP film by turns, as compared with electroplating, a man day is remarkably reducible.
[0018] In addition, what is necessary is just to determine suitably in the above-mentioned example, in consideration of the thickness which is stabilized by the CoB film and can form membranes, the tolerance (it to be desirable to make it as thin as possible as for the thickness as a nonmagnetic membrane) of the volume for nonmagnetic of NiP, all thickness, and a number of layers, although referred to as 0.5 micrometers and 0.1 micrometers as each thickness of a CoB film and a NiP film, respectively. however, the thickness of a NiP film -- fragmentation of a CoB film -- the minimum -- it is referred to as required 10nm, and a CoB film is carried out to more than the double precision at least
[0019] Drawing 2 is the cross section showing the 2nd example of this invention. this example is the same as that of a last example fundamentally, and a different place is having formed the film 31 of hard magnetism or half-hard magnetism between the nonmagnetic substrate 11 and the soft-magnetism backing layer 12. A CoCr film with a thickness of 0.1 micrometers can be used for the film 31 of this hard magnetism or half-hard magnetism. By the spatter, this CoCr film can be formed at power density 5.5 w/cm2, gas ** 5mTorr, and the substrate temperature of 150 degrees C. And it leaves residual magnetization to this film in the uniform direction during membrane formation or after membrane formation.
[0020] The grant method of residual magnetization uses a permanent magnet as shown in drawing 3 or drawing 4 . It is what combined the magnet 42 in a circle magnetically combined with the yoke 43, and the pillar-like magnet 41, and the disk substrate under membrane formation or after membrane formation is made to counter a magnet, as shown in this drawing, it is magnetized to radial, and the method shown in drawing 3 gives residual magnetization. The method shown in drawing 4 is located so that a part of disk substrate may counter using the magnets 51 and 52 of two rectangular parallelepipeds combined magnetically with a yoke 53, and it gives residual magnetization to the circumferencial direction of a substrate by rotating a disk substrate.
[0021] Thus, on the hard magnetism which gave residual magnetization, or the half-hard magnetism film 31, the multilayer of the CoB film 21 and the nonmagnetic membranes 22, such as NiP, is formed like the 1st example. Thus, over a round, the modulation wave of this example which formed membranes is homogeneity, and will become good. In addition, although the CoCr film of hard magnetism was used for this example as an example of hard magnetism or a half-hard magnetism film, material, such as Co alloy, a gamma ferric oxide, and a chrome oxide, may be used for it. Moreover, you may use a FeCo system alloy etc. as a half-hard magnetism film.
[0022] Moreover, although the above 1st and the 2nd example used the spatter CoCr system alloy film as a perpendicular magnetic recording layer, it cannot be overemphasized that the other materials, especially the CoNiRe system alloy of plating, etc. may be used. Moreover, you may prepare protective coats, such as a carbon film, and lubricating film on a perpendicular magnetic recording layer if needed.
[0023]

[Effect of the Invention] If it depends on this invention, it will become possible to obtain the backing layer of the thickness of mum order easily with electroless plating which was excellent in mass-production nature by dividing this backing layer at least by nonmagnetic membranes, such as NiP, more than two-layer, using a CoB film as a soft-magnetism backing layer.
[0024] Moreover, after forming hard magnetism or a half-hard magnetism film on a nonmagnetic substrate, giving radial [of a nonmagnetic substrate] to this film and giving residual magnetization to a circumferencial direction, by forming the backing layer which divided the CoB film by nonmagnetic membranes, such as NiP, the magnetic anisotropy of a CoB film can be arranged with radial [of a nonmagnetic substrate / the circumferencial direction or radial], the magnetic properties in a round of a disk can be made uniform, and a good modulation property can be acquired. Therefore, the vertical-magnetic-recording medium which is excellent in mass-production nature, and has good record reproducing characteristics is obtained.

[Translation done.]